Front page

Department of Economics

Examination paper for SØK3524 Environmental and Resource Economics

Examination date: 23.11.2023

Examination time (from-to):09:00 – 14:00

Permitted examination support material:
Mathematical manuals:
Knut Sydsæter, Arne Strøm og Peter Berck (2006) Matematisk formelsamling for økonomer, 4utg. Gyldendal akademiske.
Knut Sydsæter, Arne Strøm, og Peter Berck(2005): Economists' mathematical manual, Berlin.

Approved calculator: Casio fx-82ES PLUS, Citizen SR-270x, SR-270X College or HP 30S

Academic contact during examination: Irmelin Helgesen
Phone:92250647

Academic contact present at the exam location: No

OTHER INFORMATION

Get an overview of the question set before you start answering the questions.

Read the questions carefully and make your own assumptions. If a question is unclear/vague, make your own assumptions and specify them in your answer. Only contact academic contact in case of errors or insufficiencies in the question set. Address an invigilator if you wish to contact the academic contact. Write down the question in advance.

Hand drawings: All questions can be answered on handwritten sheets and/or directly in Inspera. At the bottom of the question you will find a seven-digit code. Fill in this code in the top left corner of the sheets you wish to submit. We recommend that you do this during the exam. If you require access to the codes after the examination time ends, click "Show submission".

Weighting: The questions are weighted. This is to let you know how much each question count towards your final grade, the weights should also give you an indication on what is expected, and how to manage your time during the exam.

Notifications: If there is a need to send a message to the candidates during the exam (e.g. if there is an error in the question set), this will be done by sending a notification in Inspera. A dialogue box will appear. You can re-read the notification by clicking the bell icon in the top right-hand corner of the screen.

Withdrawing from the exam: If you become ill or wish to submit a blank test/withdraw from the exam for another reason, go to the menu in the top right-hand corner and click "Submit blank". This cannot be undone, even if the test is still open.

Access to your answers: After the exam, you can find your answers in the archive in Inspera. Be aware that it may take a working day until any hand-written material is available in the archive.

1 Question 1 (40%)

Fill in your answer here

Format | B I U x_2 x^2 I_x | Ω | Σ

Words: 0

Maximum marks: 40

2 Question 2 (20%)

Fill in your answer here

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Words: 0

Maximum marks: 20

3 Question 3 (20%)

Briefly explain why game theory may be particularly relevant when analyzing international aenvironmental problems. Then use the Prisoners dilemma game to discuss the prospects of international environmental policy.

Fill in your answer here

Format

Words: 0

Maximum marks: 20

4 Question 4 (20%)

Fill in your answer here

Format

Words: 0

Maximum marks: 20

Question 1
Attached

Question 1 (40%)

Consider a dynamic «open-access» fishery where the population of the fish stock is governed by

(1) $\dot{X}_t = F(X_t) - q_t$

Where natural growth ($F(X_t)$) is given by the logistic growth function and harvesting (q_t) is given by the Schaefer harvesting function.

The effort adjusts to profitability according to

(2) $\dot{E}_t = \alpha(pq_t - cE_t)$

Where $\alpha > 0$ is an adjustment parameter.

a) Give a brief interpretation of α
b) Find the economic and ecological equilibrium of the system.
c) Draw a phase-plane diagram and analyze the dynamics when originally being outside equilibrium.
d) Use the model to discuss the statement "An open-access fishery will always lead to complete extinction of the fish stock"

Question 2
Attached

Question 2 (20%)

a) Why did Kurtilla and Fisher (1975) argue that the value of wilderness amenity services, relative to the prices of inputs and outputs from development, would be increasing over time?

b) Consider a standard cost benefit analysis of a development project such as

$$NPV = \int_0^T (B - C)e^{-rt}dt - \int_0^T P\, e^{-rt}dt$$

where B and C are the benefit and cost streams associated with development, and P is the stream of environmental benefits of preservation (i.e. not developing).

Show how the Kurtilla-Fisher argument can be implemented and discuss the potential implications of making this adjustment.

Question 4
Attached

Question 4 (20%)

Two firms, 1 and 2, are polluting a lake. The Environmental Protection Agency (EPA) has decided to cap emissions to $\overline{M}$ per unit of time. Without abatement (business as usual) the emission of each firm will be $\widehat{M_i}$ $(i = 1,2)$. Due to different technology, the abatement cost of the two firms is different. The cost functions are given as $C_i = a_i(\widehat{M_i} - M_i) + b_i(\widehat{M_i} - M_i)^2$ where M_i is the emissions of firm i and $(\widehat{M_i} - M_i)$ is the amount of abatement.

a) Formulate the EPA's planning problem when the goal is to minimize total abatement cost.
b) Find the social optimal emission of the two firms.
c) Demonstrate how the firms can be regulated to generate the socially optimal solution.